MERRIAM (C. Hart)

Biology in our Colleges — a plea for a broader and more liberal biology. — —

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Merriam (C. H.)

SCIENCE

NEW YORK, JUNE 30, 1893.

THE EVOLUTION OF CONSCIOUSNESS AND OF THE CORTEX.

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It would be difficult to find an illustration of the mutual interdependence of the biological sciences more striking than that afforded by the recent contributions from morphology, embryology, physiology, and pathology to our knowledge of the significance of the cerebrum.

It has been customary to scout at any substantial contribution to psychology from the experimental sciences, and even now, when so much attention is given to psycho-physics or physiological psychology, far too little use is made of the data of modern embryology and histology. It should be apparent to all who are not *a priori* convinced that no relation exists between consciousness and the nervous system, that no satisfactory super-structure can be reared upon any other foundation than that afforded by a minute study of the structure and function of the brain.

It is the great triumph of modern embryological histology, with Professor His as its leader, to have discovered the essential similarity of all nervous elements. What Schwann did for biology at large by means of the cell theory, Professor His has done for neurology through his theory of the neuroblast and its supplement, the "neuron theory."

It was inevitable that we should soon recognize the essential similarity in origin and structure of all nervous cells. The present writer has insisted for some years that the entire fabric of the nervous system, with the exception of a few connective and nutritive elements of secondary nature, is woven by the interblending of neurons of similar character. All such neurons are formed from the epiblast or its derivatives (the perplexing relations of the sympathic system aside). Each neuron arises from neuroblasts or formative cells springing from the ectal surface (ventricular surface by invagination in the case of the axial nervous system), and, after migration to its definitive site, takes on its distinctive character. It has been attempted to show that these are all transitions between the neuroblast and the wonderful variety of nervous elements. The nerves, whether springing from a special ganglion or from the neuraxis itself, are formed, in our view, from the moniliform union of neuroblasts, whose nuclei, when they have served their purpose in forming the fibre, become separated to form the nuclei of the sheath. The recent researches in nerve degeneration and histogenesis all favor this view.

Besides those elements which at once become transformed into the definitive nerve cells, we believe there are intermediate conditions or "reserves," which may subsequently be called into function. Upon this view there is a continuous intercallation of nervous elements going on — a process much more rapid during youth. From the same standpoint it seems probable that there are numerous proliferating stations, where such neurons are continually forming. In the cerebellum and medulla, and even in the cerebrum itself, there are such loci of rapid development. No exception has so far been encountered to the law that the neurons of the central system all spring directly or indirectly from the ventricular surface.

An attentive comparative study of the various groups of vertebrates shows that the development of the various parts of the brain obeys simple and readily discoverable laws, which, when recognized, are as self-evident as the gastræa formation of the embryo. The modifications of the brain-tube, from its primitive uniformity to the wonderful complexity to which it attains in man, form a consecutive series without any complexing hiatus.

Interest attaches particularly to the cerebrum, by reason of its preëminent position, as the latest structural modification, and its close relation to the phenomena of consciousness. Since Rückhard showed that in the fish the roof or cortex of the cerebrum is wanting, or rather represented by a non-nervous membranous pallium, considerable modifications in our conceptions of the sphere of consciousness have been rendered necessary. Remarkable experiments show that the whole cerebrum may be removed without making any noticeable difference in the habits and activities of the fish (save in the case of those functions associated with smell). The writer has studied the axial lobe of the cerebrum of fishes and described numerous distinct cell-clusters and tracts which had hitherto been overlooked. He suggested that the undifferentiated prototypes of the cell-masses, which in higher vertebrates occupy the cortex, are, in this case, retained in the axial lobes. It was shown that the centres for the sense of smell are highly and specially developed, and are connected by strong and distinct tracts with the olfactory organs. It was even ventured to locate a homologue of the hippocampus upon the basis of the tracts. This procedure was evidently regarded by some as rash, but has been amply justified by subsequent developments.

In reptiles we located the olfactory centre or hippocampal lobe in a large part of the cortex, which is closely associated with a curiously modified part of the axial lobe. We suggested that the cortical elements arise as proliferations from the axial lobe, which push out into the thin cortical walls or pallium. In the *Leuckart Festschrift* it was shown that the preplexus in amphibia is analogous in early position and structure to the pallium of fishes.

In a recent number of the *Anatomischer Anzeiger* Dr. Edinger, who is perhaps the ablest living comparative neurologist, works out this form of the solution of this problem in detail with respect to the olfactory and hippocampus. Accepting the suggestion of proliferation from the axial lobe, he shows that the earliest cortex to be formed is that which, in higher vertebrates, is termed ammonshorn or hippocampus. In other words, consciousness first intervenes in the construction of data from the olfactory sense. This suggestion is enforced by the data of comparative morphology. The olfactory is the most primitive of the special sense-organs, and is most closely associated with the cerebrum.

Several years ago we proposed the theory that consciousness must have appeared very late in the evolution of psychical functions; the higher expressions of this faculty, such as reflection, being among the latest endowments of the race. It was shown that such a view would give us less concern in the bloodthirsty procession of ferocious animals which have reddened every page of geologic history. When the greatest diameter of the nerve-tube was in the pelvic region, it was unnecessary to predicate consciousness as a pre-requisite to the simple avocations of the animal.

We believe that, under the law of natural selection, consciousness could only appear when the arena was opened for its serviceable exercise.

Remarkable confirmation of the comparatively accessory status of consciousness has been obtained from two such different sources as the study of hypnotism and experimental psychology. In a most interesting paper printed in the June number of the *Journal of Comparative Neurology* Dr. Edinger describes the results of an examination of the brain of a dog, from which Professor Goltz had removed the *entire cerebrum on both sides*.

The dog lived eighteen months, but, contrary to the predictions of the sceptical, the cerebrum proved to be all but entirely removed. The special senses were not destroyed except smell. Locomotion was not impaired, and general sensation was intact.

Although the animal was completely imbecile, it retained the nervous mechanism for nearly all bodily functions. While these results seem, at first, contradictory to those derived from extirpation and electrical stimulation, yet, as Edinger shows, they merely indicate that the organs and processes of consciousness are merely superposed upon the substructure of the instinctive processes and axial centres.

In man, who has acquired greater dependence upon reflection and other higher functions, the primitive independence of the lower centres is retained for a relatively short time during childhood. The above illustration may at least serve to show how mutually dependent all these sciences are and that we seem to be gradually approximating toward a connected theory of nervous action and evolution.

SOME CURRENT NOTES UPON METEORITES.

BY S. C. H. BAILEY, OSCAWANA-ON-HUDSON, N.Y.

IT may well be hoped that the revived attention which has recently been shown in the study of that interesting class of bodies known as meteorites, will result in giving us a more practical, if not a more certain, basis for their consideration. If in the onset we meet with conflicting theories and much uncertain data, we are only upon the same ground where most scientific inquiry begins. If we cannot tell whence an aerolite comes, we usually do know the fact and date of its fall, its chemical and lithological composition, specific weight and peculiarities of structure, the phenomenon attending its flight, and often the precise radiant point from whence it came. We hold the object in our hands, and can study its physical properties, and its cosmic as well as its telluric history. All these particulars have been observed, compared, studied, and in part determined by thoroughly competent scientific men, and yet, to-day, there is no accepted scientific name to indicate their special line of research, none for this department of science itself. These primary needs are yet to be filled. Heretofore two distinguished writers and students in this field of inquiry have each proposed a specific name for the science, and, while neither of the terms seems to be objectionable, neither of them seems to have been generally adopted or used. In 1847 Shepard proposed the term "Astropetrology," and in 1863 Story-Maskelym suggested that of "Aerolitics" to distinguish it as a department of science. Both from the priority of suggestion, and as a fitting tribute to the zeal and valuable labors of Professor Shepard in that behalf, will it not be proper and convenient to adopt his proposed name, astropetrology, which, in accordance with common usage, by a simple change of its final syllable "gy" into "gist," will also designate a person devoted to its study? How comes it that a subject presenting most interesting and possibly serviceable problems in astronomy and physics should thus far be deficient in the very rudiments of a distinctive science — even a name? Certainly not from lack of patient labor and intelligent investigation by thoroughly competent men. Smith and Genth upon its chemical side, and Newton, Eastman, Langley, Kirkwood, and others upon its astronomical, have, in our country, done much to determine the data upon which present theories rest; while abroad, among a host of others, Haidenger, Meunier, Tschermak, and Brazina have worked at the very bases of efficient progress in scientific research, investigation, and the classification of the objects themselves. In this last-mentioned feature, however, lies a discouraging fact. These several systems do not agree, or rather, while serviceable and consistent in themselves, they, to some extent, seem to antagonize each other in the hands of the collector or possessor of meteoric examples. In a given example not properly labelled, or when labels have been confused, and perhaps changed places, its possessor will probably find it quite accurately described upon reference to one of these systems, but from caution, upon reference to another system, he will find described peculiarities not seen in, and possibly antagonistic to, the same fall as that which he has in hand. How is he to identify it? Specific weight may help the determination, but, standing alone, it cannot be conclusive. Chemical analysis is impracticable and not wholly conclusive. Now, if the absolute necessity of accuracy in the identification of the fall is considered for a moment, there will also result a partial appreciation of its vast importance in all its collateral as well as direct relations. For instance, the supposed example almost exactly resembles another described fall, but one occurred in India, A.D. 1822, while the other fell in Iowa in 1847, both were well observed as to radiant point, time, and course of flight, but each was the reverse of the other in all these important particulars; in short, they only resemble each other in physical characters, and a confusion of their identity may destroy all their value as data in their theoretical and astronomical relations. Identity of radiant point, time, and course of flight and a possible periodicity in observed falls will interest the astronomer even more than identity of chemical composition or physical characters, though each is a factor in his theory, and each must be, if possible, an observed fact. If a single fact may uphold or upset a theory, it should certainly be an observed fact. The purpose of these observations is to inquire what may be done to base investigations of these wonderful phenomena, the most suggestive and impressive of nature's visible displays, and the objects which they bring to us from the regions of space, upon ground more worthy of consideration and research, than as merely objects of a collecting fad, or a money-making zeal in collecting and selling examples. May we not begin by some practical methods for determining and perpetuating the identity of each example by describing and authenticating with the greatest exactness every fall and every fragment? For accomplishing this purpose the number of examples is already large, but it will be constantly augmented by new accessions which may present new physical features and new, perhaps more definite, data, the value of which will be carefully determined by the astronomer and chemist, and probably with greater fidelity and accuracy than by the observer who witnessed its fall, or the author who has the example in his hand from which to write its description. In a subsequent paper I shall venture to suggest some simple expedients for avoiding some defects and errors which have become a great and increasing obstacle to progress in this most interesting department of science.

BIOLOGY IN OUR COLLEGES: A PLEA FOR A BROADER AND MORE LIBERAL BIOLOGY.

BY C. HART MERRIAM, WASHINGTON, D.C.

WHEN it became fashionable to study physiology, histology, and embryology, the study of systematic natural history was not only neglected, but disappeared from the college curriculum, and the race of naturalists became nearly extinct. Natural history, as formerly understood, comprised geology, zoölogy, and botany, and persons versed in these sciences were known as naturalists. Geology gradually came to occupy an independent field, and is now everywhere taught separately; hence, for present purposes, it may be dismissed, with the reminder that the naturalist who knows nothing of geology is poorly equipped for his work. A knowledge of the two remaining branches — the biological branches — was looked upon as sufficient to constitute a naturalist. But the kind of knowledge taught underwent a change; the term "naturalist" fell into disuse to be replaced by "biologist," and some would have us believe that even the meaning of the word biology is no longer what it was. Systematic zoölogy has gone, or, if still tolerated in a few colleges, is restricted to a very subordinate position. Systematic botany is more fortunate, still holding an honored place in many universities, though evidently on the wane.

Is it not time to stop and inquire into the nature of the differences between the naturalist and the modern school of instructors who call themselves "biologists;" into the causes that have brought about so radical a change, and into the relative merits, as branches of university training, of systematic biology compared with the things now commonly taught as biology?

Is it not as desirable to know something of the life-zones and areas of our own country with their principal animals and plants and controlling climatic conditions, as to be trained in the minute structure of the cellular tissue of a frog? And is not a knowledge

of the primary life regions of the earth, with their distinctive types, as important as a knowledge of the embryology of the crayfish?

Naturalists delight in contemplating the aspects of nature, and derive enjoyment from studying the forms, habits, and relationships of animals and plants; while most of the self-styled "biologists" of the present day direct their studies to the minute structure (histology) and development (embryology) of a few types — generally lowly forms that live in the sea — and are blind to the principal facts and harmonies of nature. Imbued with the spirit of evolution, they picture in their mind's eye the steps by which the different groups attained their present state, and do not hesitate to publish their speculations — for "they know not what they say." Their lives are passed in peering through the tube of a compound microscope and in preparing chemical mixtures for coloring and hardening tissues; while those possessing mechanical ingenuity derive much satisfaction in devising machines for slicing these tissues to infinitesimal thinness. An ordinary zoölogist or botanist is not constituted in such a way as to appreciate the eagerness and joy with which one of these section-cutters seizes a fraction of a millimetre of the ductless gland of a chick or the mesoblast of an embryonic siphonophore; nor is it vouchsafed him to really understand, though he may admire, the earnestness, devotion, unparalleled patience, and intense satisfaction with which the said investigator spends years of his life in hardening, staining, slicing, drawing, and monographing this same bit of tissue.

Such "biologists" have been well characterized by Wallace as "the modern school of laboratory naturalists"— a class "to whom the peculiarities and distinctions of species, as such, their distribution and their affinities, have little interest as compared with the problems of histology and embryology, of physiology and morphology. Their work in these departments is of the greatest interest and of the highest importance, but it is not the kind of work which, by itself, enables one to form a sound judgment on the questions involved in the action of the law of natural selection. These rest mainly on the external and vital relations of species to species in a state of nature — on what has been well termed by Semper the 'physiology of organisms' rather than on the anatomy or physiology of organs" ("Darwinism," 1890, Preface, p. vi.).

It is hardly an exaggeration to say that in our schools and colleges the generally accepted meaning of the word biology has come to be restricted to physiology, histology, and embryology, and that the courses of instruction now given in biology cover little additional ground, save that they are usually supplemented by lectures on the morphology and supposed relationships of the higher groups. It is against this modern custom of magnifying and glorifying these branches or departments of biologic knowledge until they are made to appear not only the most important part of biology, but even the whole of biology, that I beg to enter a most earnest protest. Far be it from me to deprecate any investigation that tends, in howsoever slight a degree, to increase our knowledge of any animal or plant. Such investigations fulfil an important and necessary part in our understanding of the phenomena of life, but they should not be allowed to obscure the objects they were intended to explain.

Without a knowledge of anatomy and embryology it would be impossible to properly arrange or classify the various groups, or to understand the inter-relations of the many and diverse elements that go to make up the beautiful and harmonious whole that naturalists and other lovers of nature so much admire. Similarly, the architect would be powerless to construct the magnificent edifices that everywhere mark the progress of civilization unless he understood the nature and properties of the various parts that go to make up the finished structure; yet what would be thought of a school of architecture that limited its teachings to the strength of materials or the composition of bricks, mortar, nails, and other minor factors necessary in construction? But would not such a school be strictly comparable with the modern school of histologists and physiologists who, under the head of biology, teach little besides the minute structure and functions of tissues, ignoring the characters that constitute and distinguish species, that show the adaptation of species to environment, that show the processes and steps by which species are formed, and the causes that govern their differentiation and distribution; in brief, ignoring most that is beautiful and interesting in nature, including the great truths that enable us to understand the operations and laws of nature, for the sake of dwelling eternally on details that ought to form merely a part of the foundation for a study of nature.

The evolution of these one-sided biologists is not hard to trace. Early naturalists, such as Linnæus and Buffon, knew little of the internal structure of animals and plants; their classifications, therefore, were based chiefly on external characters, and were correspondingly crude. Cuvier was first to demonstrate the importance of anatomical knowledge in arranging animals according to their natural affinities, but his studies were confined to what is now called "gross anatomy," or the structure of such parts and organs as are visible to the naked eye.

The great improvement made in the microscope in the years 1830–1832 — at which time the spherical errors that had previously rendered its use unsatisfactory were overcome by the proper adjustment of achromatic lenses— paved the way for the discoveries in embryology and the minute structure of the tissues that made illustrious the names of von Baer, Schleiden, Schwann, and a host of others. The revelations that followed created a profound sensation among the naturalists of the time, and, as the microscope became more and more perfect, new paths were opened to the investigator, and the fascination attending its use grew. The increased demand for good instruments stimulated the invention and perfection of high-power lenses and of a multitude of accessories, the use of which, in turn, led to improved methods of treating tissues and to the discovery of bacteria and the various pathogenic micrococci of fermentation and disease. A knowledge of microscopic technic became, and justly, too, a necessary qualification in the way of preliminary training for those seeking to become biologists.

The transition from the old school to the new was but a step, and had been led up to by the course of events. The older systematic naturalists rapidly died off while still appalled by the wonderful discoveries of the microscopists; the professorships in the colleges and universities (which, at the same time, were rapidly increasing in number) were filled by young men ardent in the use of the microscope, and each anxious to excel his colleague in skill and dexterity of manipulation and in the discovery of some new form of cell or new property of protoplasm.

But one result could follow the continuance of this state of affairs, namely, the obliteration of the naturalist from the face of the earth — a result that at the present moment is well-nigh attained, for, if there is an "all-round naturalist" alive to-day, his existence is due to accident or poverty. Poverty has kept a few lovers of nature away from college, and by this seeming misfortune they have escaped the fate that would have overtaken them had they possessed the means of placing themselves under our modern teachers of biology. These teachers have deflected into other channels many a born naturalist and are responsible for the perversion of the science of biology. While deluding themselves with an exaggerated notion of the supreme importance of their methods, they have advanced no further than the architect who rests content with his analysis of brick, mortar, and nails without aspiring to erect the edifice for which these materials are necessary.

In trying to reconstruct a general naturalist at the present day, I would rather have the farmer's boy who knows the plants and animals of his own home than the highest graduate in biology of our leading university. The enthusiastic boy, whose love for nature prompts him to collect the birds, insects, or plants within reach, can be easily induced to take up the study of other groups, and thus become a local "faunal naturalist." After acquainting himself with the home fauna and flora, he may develop into a general naturalist if removed to another locality. The chief disadvantage in manufacturing naturalists in this way is that they lack the education possessed by college-bred men — a want sorely felt in after years.

To be well equipped for his work, a naturalist or biologist needs a college education; he needs laboratory instruction in modern

methods of biologic research; he needs practical training in systematic and faunal zoölogy and botany with special reference to the extent of individual variation in species, the modification of species by food and environment, and the nature and constancy of specific characters in different groups; he should have the benefit of lectures on the principles of biology and on the geographic distribution of life; and he should be taught to work out for himself the relationships and probable genetic affinities of the members of a few well-selected genera in different groups.

The teacher and professional student who aspire to tread the higher paths of biology are unworthy of their chosen field unless they possess a broad and comprehensive grasp of the phenomena of living things — a grasp that comes only after years of patient study and personal familiarity with animals or plants. Perhaps the true explanation of much of the prevalent kind of biology may be found in the circumstance that a considerable proportion of our teachers are the output of a few institutions in which their studies have been guided by section-cutters and physiologists. They are well trained in methods of research in limited fields, which training may be acquired in the brief space of three or four years, but are ill fitted to impart a knowledge of the leading facts and principles of biology, or of the kind of biology likely to prove most useful to the average student.

Some of our universities encourage and support the most abstruse and recondite investigations in the field of pure science, without regard to an economic outcome — for which they deserve the greatest credit — but such studies are rarely suited to the requirements of the ordinary college curriculum. On the contrary, the tendency of the times in matters of instruction is to render undergraduate courses more practical, so that the knowledge acquired may be useful in after life. With this end in view, it may not be amiss to inquire how the kind of biology now commonly taught compares with systematic and faunal zoölogy and botany? Will anyone attempt to maintain that 10 per cent of the present teaching is of any value in after life, except to the specialist, or that more than one per cent of the students taught biology become specialists? It seems clear, from the standpoint of availability in the ordinary walks of life, that the prevalent kind of biology teaching is a failure. Systematic and faunal zoölogy and botany, on the other hand, while fully equal to the branches now taught as a means of mental discipline, have in addition an economic value, and are sources of permanent interest and happiness to the majority of mankind. Huxley, in one of his early public lectures, said: "To a person uninstructed in natural history, his country or sea-side stroll is a walk through a gallery filled with wonderful works of art, nine-tenths of which have their faces turned to the wall. Teach him something of natural history, and you place in his hands a catalogue of those which are worth turning round. Surely our innocent pleasures are not so abundant in this life that we can afford to despise this or any other source of them" ("Lay Sermons, Addresses, and Reviews," London, 1870, pp. 91–92). Not only are excursions into the country or to the sea thus made more enjoyable, and the tedious delays at the railway station converted into sources of entertainment and profit, but even much of the drudgery and routine of everyday life may be turned to good account. Instead of the mental stagnation that naturally follows the automatic performance of a monotonous daily task, there is an incentive to observation that stimulates the intellect and results in the agreeable acquisition of knowledge. In short, acquaintance with our common animals and plants appeals to an inherent desire to know more of nature in the aspects commonly presented to our senses; it increases the joys and lightens the burdens of life; it promotes the healthy expansion of the intellect and the development of the nobler impulses and sentiments, making better men and better women.

Another argument in favor of a knowledge of systematic and faunal zoölogy and botany is that it largely increases the amateur element in science and brings the great mass of the intelligent public nearer the technical specialist, thus creating that interest in and appreciation of scientific research that leads to liberal endowment. The kind of biology now taught in most of our educational institutions has the opposite effect, tending to deepen the chasm between the people and the specialist. So long as an unfathonable abyss separates science from the intelligent citizen, just so long may the specialist expect to lack the earnest support on which his success so much depends.

The study of systematic and faunal zoölogy and botany may seem superfluous to the physiologist, histologist and technical specialist who are content to contribute their mite to the general fund — a not unworthy ambition — but to those who aspire to solve the problems and master the principals of biology a broader view is necessary — a view that can come only to those who possess an intimate personal acquaintance with the interrelations of living species and the nature and extent of their modifications — for how is it possible to form a clear conception of the operations of natural selection, of the effects of environment on species, of the transmission of acquired characters, of special adaptations, fortuitous variations and so on, without first knowing something of the species themselves? It is true that a few section-cutting physiologists, possessed of speculative minds, have ventured to enter the domain of philosophic biology, but it would be ungracious to contrast their productions with those of such naturalists as Humboldt, Darwin, Huxley, Wallace, Haeckel, Agassiz, Hyatt, Cope, Dall, Allen or Ward.

In order to avoid the possibility of being misunderstood, I wish to reiterate what has been already said in substance, namely, that while the present paper is intended as a plea for systematic biology, no complaint is made against the proportionate teaching of physiology, histology, and embryology, but only against the exclusive or disproportionate teaching of these branches, as if they comprised the whole of biology. And it may be added for the benefit of those who insist that the term biology should be restricted to the phenomena of life rather than the phenomena of living things, that, while unqualifiedly opposed to this narrow view, my present purpose is not to discuss the meaning of words, but to show the necessity of remodelling the current one-sided courses of instruction by the addition of systematic and faunal zoölogy and botany, with a view to the development of a broad and comprehensive school of biology, worthy of the age in which we live.

In my judgment, university training in biology should comprise:

1. *Elementary instruction in general biology*, including cell structure and the structure of the less complex tissues of animals and plants. This involves laboratory work with the microscope and insures the necessary knowledge of microscopic technic.

2. *Lectures on morphology, taxonomy, and the relationships* of the major groups of animals and plants, both living and fossil, supplemented by laboratory work which should be restricted to the study of types and should keep pace with the lectures, if possible.

3. *Systematic work in widely separated groups.* This work must be done in the museum or laboratory, and may be supplemented by lectures. It should include the higher vertebrates as well as invertebrates and plants. In the case of advanced students, original work should be encouraged, particularly revisions of genera.

4. *Faunal work*, consisting of the study of the life of limited areas. Care should be taken to avoid too comprehensive an undertaking; and the groups chosen for study should be selected, as a rule, with reference to the literature or specimens available for comparison. The necessary field-work, if impracticable during the college year, may be done in vacation. Whenever possible, field excursions should be made at frequent intervals during the college year, under competent supervision.

5. *Lectures on the distribution of life.* In time, paleontologic distribution; in space, geographic distribution. These lectures should be illustrated by maps, diagrams, and specimens. Access to zoölogical and botanical gardens and museums is of the utmost importance.

6. *Lectures on the principles and philosophy of biology*, comprising evolution, heredity, migrations, special adaptations, and so on.

Botany and zoölogy should be taught separately under the second and third headings, and together under the first, fifth and sixth. Under the fourth heading they might be taught either separately or together, as most convenient.

Paleontology should form an inseparable part of biology and should not be taught under geology except in its stratigraphic relations. Fossil types should be studied in connection with their ancestors and their nearest living relatives.

The pendulum has swung too far in the direction of exclusive microscopic and physiologic work. When it swings back (and I believe the time is not far distant) the equilibrium will be restored — the perverted meaning of the term "biology" will be forgotten, and the present one-sided study of animals and plants will give place to a rational biology and to the development of a school of naturalists far in advance of those who have passed away.

NOTES ON PENNSYLVANIA GERMAN FOLK-MEDICINE.

BY W. J. HOFFMAN, M.D., WASHINGTON, D.C.

WHILE collecting material relating to the folk-lore of the Pennsylvania Germans I obtained some curious beliefs pertaining to the rattlesnake, and the alleged remedies employed for curing those bitten by this reptile. Many newspaper reports are annually circulated in various portions of the Atlantic Coast States to the effect that the reporter had discovered a veritable "mountain doctor," well versed in the secret properties of plants, and that this personage was widely celebrated for his wonderful skill in curing rattlesnake bites, but that the remedy was preserved with the utmost care as a great and valued secret; or, perhaps, that the reporter of the article had received a sample, but through some unavoidable misfortune he had lost it, etc.

Having consulted with some of these so-called "mountain doctors" to obtain and exchange matters of interest — during the past twenty years — it has been found that nearly all of them employ numerous species of plants for the ills that come under their observation, but that only a few are really acknowledged as possessing a semblance of skill, and still less who are familiar with so-called snake-bite remedies.

The plant employed by one of these "mountain pow-wows," and the only one claimed to possess any virtue, is *Sanicula marylandica*, or sanicle, termed by the natives "master-root," because it "masters the rattlesnake venom." The fresh plant and roots are pounded and soaked in boiling milk, when the mixture is applied to the wound as a poultice. A decoction of the same plant is also taken internally to induce diaphoresis. The decoction is said to be more efficacious if made with milk instead of water. I believe this to be the first instance of bringing this plant to public attention, at least as employed by these superstitious herbalists, and for the purpose stated; but as so much stress is placed upon the good results, even by people of recognized intelligence and education, it might not be amiss to have made a series of chemical and therapeutic experiments to test the efficacy of the remedy.

Another remedy employed by the superstitious of the mountain regions of middle and eastern Pennsylvania is to cut a live chicken in two, and to place the warm, raw surface of one part upon the part bitten by the snake.

Rattlesnakes are of value to the mountain doctors for several reasons. The oil, obtained by draining the reptile after skinning is used to cure deafness. The rattle, suspended from a string, and worn by a baby, will have the power of preventing the wearer from having convulsions during dentition. The tongue of the snake, when worn in the glove, will have the power of compelling any girl, who grasps the gloved hand, to love the one so greeted, even should she ordinarily be indifferent to his attentions.

Finally, to secure rattlesnakes, the "doctor" grasps a silk handkerchief at one corner, and allowing the other end to hang toward the serpent, teases her until she strikes it with her fangs, when he immediately raises the handkerchief from the ground, thus depriving the snake of any opportunity of disengaging herself therefrom, as the slightly recurved fangs are hooked in the material. The "doctor" then either kills the serpent by first grasping her neck with the disengaged hand, so as to prevent her biting him, when he cuts off her head. Should he desire, however, to keep the snake as a curiosity or for sale, he will extract the fangs with a small pair of forceps.

NOTES AND NEWS.

PROFESSOR RICHARD A. PROCTOR, the well-known astronomer and writer, died in 1889, of yellow fever, in New York City. His children were in Florida at the time, and could not be present at the funeral. No suggestion of a resting-place being forthcoming, the astronomer's remains were buried in the undertaker's private lot in Greenwood. The body, it was understood, was to remain there until other arrangements could be made. The lot was in an out-of-the-way part of the cemetery, and the grave was neglected, there being not even a stone to mark the place. The children of the astronomer are all making their own living, and while their wish was to bury their father better, the means were not at hand. Recently, through the efforts of Mr. Edward W. Bok, attention has been called to the matter, and Mr. George W. Childs of Philadelphia, has, with his usual generosity, purchased a lot in Greenwood, near the Flatbush entrance, to which the astronomer's remains will be removed, and in October it is hoped that a suitable sarcophagus of granite will be dedicated with due ceremony.

— The U. S. National Museum has recently come into possession of a very remarkable collection of petrified trunks of an extinct species of tree belonging to a family of plants that is now very rare, but which once formed a prominent feature of the landscape of nearly all countries. These plants are intermediate in appearance between tree-ferns and palms, and have as their best known living representative the common sago-palm, *Cycas revoluta*, of our greenhouses. The fossil trunks above mentioned are from one to three feet in height and from six inches to two feet in diameter. They are in a very perfect state of preservation, turned to solid stone of a brown color. The largest one weighs 900 pounds, and is the largest object of the kind ever reported from any part of the world. They were found lying on the surface of the ground in the vicinity of Hot Springs, South Dakota, and were all sent to Washington by mail under the frank of the Interior Department. The geological formation in which they occurred is not known with certainty, but this class of plants reached its greatest perfection in what is known as Secondary, or Mesozoic time. It is therefore altogether probable that these trunks grew at that remote age and have lain strewn over the plains for millions of years waiting for science to gather them in and make them help tell the story of the earth. They have been placed in the Department of Fossil Plants, in charge of Prof. Lester F. Ward, who recently superintended the taking of fifteen views of them by the accomplished photographer of the National Museum, Mr. T. W. Smillie. This is one of the most important accessions the museum has received of late, and when the collection is elaborated and the results published it will make a valuable contribution to science.

— At Denison University, Granville, Ohio, a new scientific building, known as Barney Hall, is approaching completion. The building, which is one of the most substantial scientific buildings in the West, will cost when finished about $65,000, and will include chemical and physical laboratories, as well as a museum and laboratories of biology. Special attention is to be devoted to neurology and comparative neurology. An extended graduate course in biology, and a number of fellowships have been provided with corresponding increase in faculty.

— "The Story of My Life," by Dr. Georg Ebers, is the title of a delightful autobiography, full of fascinating reminiscences, which will be published immediately by D. Appleton & Co. This autobiography tells of Dr. Ebers's student life in Germany, his association with movements like that for the establishment of kindergarten training, his acquaintance with distinguished men like Froebel and the brothers Grimm, his glimpses of revolutionary movements, his interest in Egyptology and the history of ancient Greece and Rome, and the beginnings of his literary career.

— Without making invidious comparisons, it is safe to say that the exhibit which Messrs. Houghton, Mifflin & Co. have arranged in the gallery in the northwestern corner of the Department of Liberal Arts in the Manufacturers' Building at Chicago is in all respects worthy of somewhat careful examination. The idea evidently is to represent such a library as might be found in the house of a man of cultivation in any part of the United States.

SCIENCE:

PUBLISHED BY N. D. C. HODGES, 874 BROADWAY, NEW YORK.

SUBSCRIPTIONS TO ANY PART OF THE WORLD, $3.50 A YEAR.

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CONGRESS OF CHEMISTS AT CHICAGO.

THE committees in charge of the congress have selected Monday, Aug. 21, as the date of the opening of the Congress of Chemists to be held in connection with the Columbian Exposition, in Chicago. The chairman of the committee appointed for coöperation in this congress by the American Association for the Advancement of Science, Chemical Section, is Professor Ira Remsen, Johns Hopkins University, Baltimore, Md. The chairman of the committee appointed by the American Chemical Society is Dr. Wm. McMurtrie, 106 Wall Street, New York, N.Y. The chairman of the committee of the World's Congress Auxiliary, on Congress of Chemists, is Professor John H. Long, 2421 Dearborn Street, Chicago, Ill. The various committees have organized by selecting Dr. H. W. Wiley, chief chemist of the Department of Agriculture, Washington, D.C., as chairman, and Professor R. B. Warder, Howard University, Washington, D.C., as secretary.

The work of the congress has been divided into ten sections, and a temporary chairman has been selected for each section, as follows: Agricultural Chemistry, H. W. Wiley, Department of Agriculture, Washington, D.C.; Analytical Chemistry, A. B. Prescott, Michigan University, Ann Arbor, Mich.; Didactic Chemistry, W. E. Stone, Lafayette, Ind.; Historical Chemistry and Bibliography, H. C. Bolton, University Club, New York.; Inorganic Chemistry, F. W. Clarke, Geological Survey, Washington, D.C.; Organic Chemistry, I. Remsen, Johns Hopkins University, Baltimore, Md.; Physical Chemistry, R. B. Warder, Washington, D.C.; Physiological Chemistry, V. C. Vaughan, Michigan University, Ann Arbor, Mich.; Sanitary Chemistry, H. Leffmann, 715 Walnut Street, Philadelphia, Pa.; Technical Chemistry, Wm. McMurtrie, 106 Wall Street, New York, N.Y.

General and special invitations have already been issued to foreign chemists, and many replies have been received, indicating a large attendance of chemists from abroad at the congress. The following distinguished foreign chemists have already promised to present papers to the congress, and the list will, without doubt, be increased many fold before the date of the opening: Professor L. G. M. Ernest Milliau, Marseilles, On Standard Methods of Oil Analysis; Mr. Farnham Maxwell Lyte, London, On the Production of Chlorine; Mr. H. Droop Richmond, London, On the Accuracy of the Methods of Analyses of Dairy Products; Mr. Pierre Manhes, Lyon, subject to be announced later; Professor B. Tollens, Goettingen, Researches on the Synthesis of Polyatomic Alcohols; Professor Ferd. Tiemann, Berlin, subject to be announced later; Mr. H. Pellet, Brussels, On the Methods of Determining the Percentage of Sugar in Beets; Mr. H. R. Proctor, Leeds, On the Examination of Tanning Materials; Mr. O. Kemna, Antwerp, On the Purification of Water; Mr. Otto Hehner, London subject to be announced; Professor C. A. Bischoff, Riga, subject to be announced; Professor G. Lunge, Zürich, On the Method of Teaching Technological Chemistry at Universities and Polytechnic Schools; Professor Ludwig Mond, Rome, subject to be announced; and Professor W. N. Hartley, Dublin, subject to be announced.

American chemists are invited to take an active interest in the congress and to be present, or, if that is not possible, to send papers on some of the subjects indicated in the classification above mentioned.

Chemists specially interested in each of the subjects for discussion are invited to correspond with the chairmen of those sections in regard to the character of the work and of the papers expected. All chemists who expect to read papers at the congress are earnestly requested to send the titles thereof to the chairman of the General Committee, Dr. H. W. Wiley, Department of Agriculture, Washington, D.C., on or before the first day of August. It will be difficult to arrange for a position on the programme for the titles of any papers which may be received after that date. The time required for each paper should also be noted, so that daily programmes can be provided for in advance. In all cases the place of honor on the programme will be given to foreign contributors. Papers or addresses can be presented in English, French, or German, as the author may select, but where convenient the English language will be preferred.

The committee desires to ask those chemists who propose to attend the World's Congress to make an excursion during the week previous to the meeting to Madison, Wisconsin, for the purpose of attending the meetings of the Chemical Section of the American Association for the Advancement of Science. This will not only be a delightful excursion, as Madison is distant only about four hours from Chicago, but will also enable the participants in the congress to make the acquaintance of the scientific men of the United States and other countries engaged not only in chemical, but also in other branches of science.

Other attractions in Chicago will be meetings of different chemical societies. Among these may be mentioned the American Chemical Society, the annual meeting of which will begin Aug. 21, and the Association of Official Agricultural Chemists, which will hold its annual meeting in Chicago, beginning Thursday, Aug. 24. The sessions of these societies will be so ordered as not to conflict with the business of the congress. The American Pharmaceutical Association, which has a strong chemical section, will also meet in Chicago at or near this time. It is hoped that the Institute of Mining Engineers may also hold its meeting about this time, although no definite announcement can be made in regard to this matter. It is thus seen that this occasion will bring together the active workers in all branches of chemical science in the United States, and enable American chemists to make the acquaintance of distinguished co-laborers from abroad, and the visiting chemists to meet the largest possible number of their fellow-laborers here.

Every possible arrangement will be made for the convenience and comfort of visitors. Intending participants in the congress should address Professor John H. Long, 2421 Dearborn Street, Chicago, Ill., for information in regard to quarters and other accommodations. On arrival in Chicago visitors should report at once to the congress headquarters, Art Institute Building, Lake Front and Adams Streets, where full information will be given them in regard to matters connected with their personal comfort. Wherever possible, intending visitors should write a few days before their arrival to the committees above mentioned, in order that special provision may be made for their comfort when they reach Chicago.

In regard to the climate of Chicago in August, much can be said in praise. While warm days may sometimes be expected, the situation of the city on the edge of a vast, open prairie, extending for nearly a thousand miles north and west without a break, secures even in the hottest day refreshing breezes which cool the atmosphere and mitigate the heat of summer. The lake breezes also do much to render the climate moderate. No one need be deterred from attending the congress on account of fear of severe heat.